REMARKS

In response to the Office Action mailed April 22, 2004, the Applicant respectfully requests that the Examiner enter the above amendments and consider the following remarks. Claim 21 has been amended and claims 66-72 and 81 have been canceled. In addition, claims 15-18, 33, and 73-80 are withdrawn. As a result, claims 15-31, 33-65, 73-80, and 82 are pending in the application. The Applicant respectfully requests further examination and reconsideration of the application in light of the amendments and accompanying remarks.

Election/Restrictions Under 35 U.S.C. § 121 and 372

The Examiner has required restriction of claims under 35 U.S.C. §§ 121 and 372. The Examiner claims this application contains groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. The Applicant respectfully elects the claims of Group II, namely claims 19-31, 34-72, 81, and 82, drawn to a method of making coke and the coke product. As requested by the Examiner, this affirms the provisional election made with traverse to prosecute the invention of Group II, in accordance with a telephone conversation with Jeffrey Norris on April 6, 2004.

Double Patenting

Claim 81 was objected to under 37 CFR 1.75 as being a substantial duplicate of claims 34. The Applicant respectfully submits that claim 81 has been canceled in light of the objection.

Claim Rejections Under 35 U.S.C. § 112

The Examiner rejected claims 21 and 66-72 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. In particular, claim 21 is indefinite because the expression "said VCMs" lacks proper antecedent basis in claim 19. Claims 66-72 were also asserted to be indefinite because claim 66 depends on canceled claim 32, and thus, the scope of each claim cannot be ascertained. Claim 21 has been amended and claims 66-72 have been canceled to address these concerns.

Claim Rejections Under 35 U.S.C. § 103(a)

The Examiner rejected claims 19-27, 29-31, 34-72, 81, and 82 under 35 U.S.C. § 103(a) as being unpatentable over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1. Claims 28 was also rejected under 35 U.S.C. § 103(a) as being unpatentable over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1 as applied to claim 25 above, and further in view of Yan (US-PAT-NO: 4,096,097). The

Applicant respectfully traverses these rejections.

Claims 19-27, 29-31, 34-65, and 82 are NOT obvious over Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1. Gamson (US-PAT-NO: 3,684,697) teaches a feedstock dilution method of the delayed coking process to produce sponge coke suitable for the manufacture of graphite and carbon electrodes used in the aluminum industry. Hydrocarbon bottoms which have low asphaltenes contents (e.g., below about 8 %) are added to coking feedstocks with asphaltenes content above about 13 % (as measured by ASTM D2006). Gamson teaches that the dilution of the asphaltenes content below 13 % (on its own) is sufficient to effect a change of coke crystalline structure from shot coke production to sponge coke production. Gamson does not teach that the asphaltenes content of the coking feedstock can still form shot coke (desolutation of asphaltenes and resins) without sufficient levels of hydrocarbons (e.g., heavy aromatics) that behave as solvents for asphaltenes. In addition, Gamson does not teach the role of resins in shot coke formation and their impact on its dilution method. Furthermore, Gamson's addition of such materials to the coke precursor material does not necessarily cause the resulting coke to have VCM amounts within the claimed ranges of this application nor improve the adsorption characteristics of the resulting coke. The Applicant respectfully submits that Gamson provides no means nor incentive to produce a coke with VCM content outside the traditional range of 8–12

wt.% for petroleum coke that is calcined to remove excess VCM and hydrogen for the manufacture of graphite and carbon electrodes used in the aluminum industry. Though the resulting coke will have improved adsorption characteristics over shot coke, Gamson's resulting coke will not attain the improved adsorption characteristics of the current invention without employing the methods of this application. In contrast, this application teaches methods (primarily operating conditions) to increase VCM levels and adsorption characteristics above and beyond traditional sponge coke.

Gamson does not teach producing a porous, sponge coke for the addition of other chemical compounds (e.g., sulfur adsorbents) for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts. Instead, Gamson teaches the production of sponge coke with characteristics favorable for the manufacture of graphite and carbon electrodes used in the aluminum industry. In contrast, the Applicant teaches various methods in the coking process to produce very porous sponge coke from coking feedstocks that normally produce shot coke in traditional coking processes. The primary method controls the coke quality via thermal process operating conditions, primarily reducing the coke drum temperature (e.g., lower heater outlet temperature or coking cycle quench). Furthermore, the current invention teaches various methods to uniformly distribute various selected additives in the petroleum coke via the coke quench media to improve pet coke fuel properties, combustion characteristics, and environmental impacts. These methods provide the

means to control the quality and quantity of the additives integrated in the modified pet coke. Thus, the methods of the current invention to produce porous sponge coke for the purpose of adding favorable chemical compounds (e.g., sulfur adsorbents) for fuel coke are distinguished over the coking feedstock dillution method of Gamson's expired patent to reduce asphaltenes content below about 13% and promote the production of sponge coke for the manufacture of graphite and carbon electrodes used in the aluminum industry; not only in methods, but also as a different purpose or new use.

The Applicant respectfully submits that DE 19540780A1 teaches a method for quenching coke with aqueous salt solutions, but not within the cracking process of this application nor for a similar purpose or use. That is, DE 19540780A1 teaches a method for quenching coke with aqueous solutions of iron (II) and iron (III) salts or monoester disodium salts of succinic acid with oxyethylenenonyl phenol. However, the 700-1000 °C temperatures (i.e., 1292 – 1832 °F) of the unquenched coke in this referenced patent indicate that the coke that is being quenched is likely from a coal-coking process or a low temperature coke calciner, but not within the quench step of this thermal cracking process, wherein coke temperatures prior to quench are in the range of 400 – 500 °C (i.e., 752 – 932 °F). Furthermore, the addition of the these chemicals in this quench are apparently for the purpose of coagulating organic impurities from biologically cleaned process water (used as quench water) to reduce environmental emissions of this quench process. The Applicant respectfully submits

that the monoester disodium salts of succinic acid with oxyethylenenonyl phenol would not be effective as a sulfur sorbent nor have significant impacts on combustion or ash characteristics of the resulting coke due to its chemical nature. As disclosed in this application, these types of chemical compounds would also be difficult to integrate within the porous coke within coke drums due to their physical structure. In other words, quenching coke that relies on a fluid flowing through macropores, mesopores, and micropores within the coke is far different from quenching coke in other processes (e.g., fluid flowing over crushed coke). Thus, DE 19540780A1 does not teach a step of integrating a chemical compound into the coke structure during the quenching step of the thermal cracking process of this application. In addition, DE 19540780A1 uses types of salt solutions (vs. those of the current invention) for different purposes, reducing environmental emissions from the coke quench due to the use of biologically cleaned process water (vs. coke fuel combustion characteristics & environmental impacts). In any case, the methods described by DE 19540780A1 apparently do not teach the controlled integration of selected chemical compounds (e.g., sulfur adsorbents) via quenching petroleum coke within the decoking cycle of the coking process in the current invention. Consequently, the Applicant respectively submits that the methods of the current invention which provide controlled injection of selected additives via coke quench for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts of burning coke are

distinguished over the quenching of coke with aqueous solutions of different types of salts in a different coking process (e.g. coal coking or low temperature coke calcining) of DE 19540780A1.

The Applicant respectfully submits that the combination suggested by the Examiner would not be obvious to one skilled in the art. The combination of the production of sponge coke via Gamson (US-PAT-NO: 3,684,697) and the coke quench system with aqueous salt solutions of DE 19540780A1 is submitted to be improper because this combination would not teach the claims of this invention. Furthermore, neither Gamson nor DE 19540780A1 suggest such a combination, and one skilled in the art would have no reason to make such a combination. Gamson does not teach or suggest a thermal cracking process or method to produce a sponge coke and further increase the porosity and improve adsorption characteristics to add additional chemical compounds to improve coke fuel properties, combustion characteristics, and environmental impacts. Likewise, DE 19540780A1 does not teach or suggest a controlled, uniform integration of desirable additives via the thermal cracking process quench to improve coke fuel properties, combustion characteristics, and environmental impacts. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the proposed combination of these references still does not teach or suggest every limitation of the present invention. Finally, the Applicant's own experience has demonstrated this combination is not obvious to ones

skilled in the art. The Applicant is working with experienced coker process engineers at refineries that have been using coking feedstocks which normally produce shot coke with traditional coking operations of the prior art. None of them use the expired patented technology of Gamson to convert shot coke to sponge coke production. Yet, these coker process engineers have asked the Applicant to make this conversion and also inject the additives of the present invention. In addition, one coker process engineer has successfully tested principles of the current invention (with permission & assistance of the Applicant) to temporarily change from shot coke to sponge coke production in their commercial unit, while using a coking feedstock that normally produces shot coke with traditional coking operations of the prior art. Thus, this combination of references is clearly not obvious to ones skilled in the art.

In conclusion, the Applicant respectfully submits that the novel thermal cracking process options and methods of the current invention are (1) unobvious to one skilled in the art and (2) these distinctions of the present invention provide surprising and unexpected results and are patentable under Section 103 because the modified sponge coke allows the integration of various desirable chemical compounds (e.g., sulfur adsorbents, high quality VCM, and oxygen-containing hydrocarbons) during the quench of the thermal cracking process (e.g., delayed coking) which can improve the coke's fuel properties, combustion characteristics, and environmental impacts. Therefore, Gamson and DE 19540780A1 provide no motivation to combine or modify the

references as suggested by the Examiner in order to arrive at the claimed invention. Only after the knowledge presented in the specification of the current invention (e.g., novel principles of how these additives improve the pet coke's fuel properties, combustion characteristics, and environmental controls) can the uniform integration of desirable additives in a porous coke crystalline structure produce the new and unexpected results of the current invention.

Claim 28 is NOT obvious from Gamson (US-PAT-NO: 3,684,697) in view of DE 19540780A1 and Yan (US-PAT-NO: 4,096,097). As stated previously, Gamson (US-PAT-NO: 3,684,697) teaches a feedstock dilution method of the delayed coking process to produce sponge coke suitable for the manufacture of graphite and carbon electrodes used in the aluminum industry. Hydrocarbon bottoms which have low asphaltenes contents (e.g., below about 8 %) are added to coking feedstocks with asphaltenes content above about 13 % (as measured by ASTM D2006). Gamson teaches the dilution of the asphaltenes content below 13 % (on its own) is sufficient to effect a change of coke crystalline structure from shot coke production to sponge coke production. Gamson does not teach that the asphaltenes content of the coking feedstock can still form shot coke (desolutation of asphaltenes and resins) without sufficient levels of hydrocarbons (e.g., heavy aromatics) that behave as solvents for asphaltenes. In addition, Gamson does not teach the role of resins in shot coke

formation and their impact on its dilution method. Furthermore, Gamson's addition of such materials to the coke precursor material does not necessarily cause the resulting coke to have VCM amounts within the claimed ranges of this application nor improve the adsorption characteristics of the resulting coke. The Applicant respectfully submits that Gamson provides no means nor incentive to produce a coke with VCM content outside the traditional range of 8–12 wt.% for pet coke that is calcined to remove excess VCM for the manufacture of graphite and carbon electrodes used in the aluminum industry. Though the resulting coke will have improved adsorption characteristics over shot coke, Gamson's resulting coke will not attain the improved adsorption characteristics of the current invention without employing the methods of this application. In contrast, this application teaches methods (primarily operating conditions) to increase VCM levels and adsorption characteristics above and beyond traditional sponge coke.

Gamson does not teach producing a porous, sponge coke for the addition of other chemical compounds (e.g., sulfur adsorbents) for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts. Instead, Gamson teaches the production of sponge coke with characteristics favorable for the manufacture of graphite and carbon electrodes used in the aluminum industry. In contrast, the Applicant teaches various methods in the coking process to produce very porous sponge coke from coking feedstocks that normally produce shot coke in

traditional coking processes. The primary method controls the coke quality via coking process operating conditions, primarily reducing the coke drum temperature (e.g., heater outlet temperature, coking cycle quench, etc.). Finally, the current invention teaches various methods to uniformly distribute various selected additives in the petroleum coke via the coke quench media to improve pet coke fuel properties, combustion characteristics, and environmental impacts. These methods provide the means to control the quality and quantity of the additives integrated in the modified pet coke. Thus, the methods of the current invention to produce porous sponge coke for the purpose of adding favorable chemical compounds (e.g., sulfur adsorbents) for fuel coke are distinguished over the coking feedstock dillution method of Gamson's expired patent to reduce asphaltenes content below about 13% and promote the production of sponge coke for the manufacture of graphite and carbon electrodes used in the aluminum industry; not only in method, but also as a different purpose or new use.

As stated previously, the Applicant respectfully submits that DE 19540780A1 teaches a method for quenching coke with aqueous salt solutions, but not within the cracking process of this application nor for a similar purpose or use. That is, DE 19540780A1 teaches a method for quenching coke with aqueous solutions of iron (II) and iron (III) salts or monoester disodium salts of succinic acid with oxyethylenenonyl phenol. However, the 700-1000 °C temperatures (i.e., 1292 – 1832 °F) of the unquenched coke in this referenced patent indicate that the coke that is being

quenched is likely from a coal-coking process or a low temperature coke calciner, but not within the quench step of this thermal cracking process, wherein coke temperatures prior to quench are in the range of 400 – 500 °C (i.e., 752 – 932 °F). Furthermore, the addition of the these chemicals in this quench are apparently for the purpose of coagulating organic impurities from biologically cleaned process water (used as quench water) to reduce environmental emissions of this quench process. As disclosed in this application, these types of chemical compounds would also be difficult to integrate within the porous coke within coke drums due to their physical structure. In other words, quenching coke that relies on a fluid flowing through macropores, mesopores, and micropores within the coke is far different from quenching coke in other processes (e.g., fluid flowing over crushed coke). Thus, DE 19540780A1 does not teach a step of integrating a chemical compound into the coke structure during the quenching step of the thermal cracking process of this application. In addition, DE 19540780A1 uses types of salt solutions (vs. those of the current invention) for different purposes, reducing environmental emissions from the coke quench due to the use of biologically cleaned process water (vs. removal of excessive coke impurities). In any case, the methods described by DE 19540780A1 apparently do not teach the controlled integration of selected chemical compounds (e.g., sulfur adsorbents) via quenching petroleum coke within the decoking cycle of the coking process in the current invention. Consequently, the Applicant respectively submits that the methods of the current

invention which provide controlled injection of selected additives via coke quench for the specific purpose of removing excessive coke impurities are distinguished over the quenching of coke with aqueous solutions of different types of salts in a different coking process (e.g., coal coking or low temperature coke calcining) of DE 19540780A1.

The Applicant respectfully submits that Yan (US-PAT-NO: 4,096,097) teaches a method for the preferential formation of sponge coke (vs. shot coke) suitable for use in the manufacture of electrodes via improved grindability characteristics. Yan (US-PAT-NO: 4,096,097) does not teach anything new with respect to the prior art of coke calcining. In many cases, excessive impurities prevent certain cokes from being calcined and used for the manufacture of electrodes in steel or aluminum production. In these situations, an additional step (claim 25) is used in the current invention to integrate reactive chemical compounds via the quenching process of this cracking process to remove excessive impurities (e.g., sulfur, nitrogen, and/or metals). After the excessive impurities have reacted to form removable compounds in this step, the resulting coke can be calcined using one of many calcining techniques of the prior art. Thus, this additional step distinguishes over traditional coke production and calcining of the prior art.

The Applicant respectfully submits that the combination suggested by the Examiner would not be obvious to one skilled in the art. The combination of (1) the production of sponge coke by dilution of asphaltenes in the feed material via Gamson

(US-PAT-NO: 3,684,697), (2) the coke quench system with aqueous salt solutions via DE 19540780A1, and (3) coke calcining via Yan (US-PAT-NO: 4,096,097) is submitted to be improper because this combination would not teach the claims of this invention. Furthermore, neither Gamson nor DE 19540780A1 nor Yan suggest such a combination, and one skilled in the art would have no reason to make such a combination. Gamson and Yan do not teach or suggest a thermal cracking process or method to produce a sponge coke to add additional chemical compounds to improve coke fuel properties, combustion characteristics, or environmental impacts. Likewise, DE 19540780A1 does not teach or suggest a controlled, uniform integration of desirable additives via the thermal cracking process quench. Futhermore, neither Gamson nor DE 19540780A1 nor Yan teach or suggest the potential addition of reactive chemicals to the coke in the quenching portion of the thermal cracking process to remove excessive impurities in the coke. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the proposed combination of these references still does not teach or suggest every limitation of the present invention.

In conclusion, the Applicant respectfully submits that the novel thermal cracking process options and methods of the current invention are (1) unobvious to one skilled in the art and (2) these distinctions of the present invention provide surprising and unexpected results and are patentable under Section 103 because the reaction of

excessive impurities to removable compounds allows the resulting coke to be calcined and used for electrodes in the manufacture of steel or aluminum. Therefore, Gamson, DE 19540780A1, and Yan provide no motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention. Only after the knowledge presented in the specification of the current invention (e.g., novel principles of how these additives react with excessive impurities) can the uniform integration of desirable additives in a porous coke crystalline structure produce the new and unexpected results of the current invention.

The Applicant respectfully submits that none of these cited references teaches the potential use of a modified pet coke to add reactive chemical compounds to the coke in the quenching portion of the thermal cracking process. The Applicant respectfully submits that any combination of these cited references would not be obvious to one skilled in the art. The combination of sponge coke production by dilution of asphaltenes or addition of carbonaceous material in the feed material and a coke quench system with aqueous salt solutions is submitted to be improper because none of the cited references suggest such a combination, and one skilled in the art would have no reason to make such a combination. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the proposed combination of these references still does not teach or suggest every limitation of the present invention. These distinctions of the present invention provide surprising and

unexpected results and are patentable under Section 103 because the modified coke allows the integration of various reactive chemical compounds during the quench of the thermal cracking process (e.g., delayed coking) which can reduce excessive impurities to sufficiently low levels to allow the resulting coke to be used for electrodes in the manufacture of steel or aluminum. Therefore, none of the cited references provide any motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention.

Since the novel physical features of the Applicant's modified coke provide these new and unexpected results over any reference, the Applicant submits that these new results indicate unobviousness and hence patentability. Therefore, the Applicant respectfully submits that no combination of the cited references can support the rejections of claims 19-27, 28-31, 34-65, and 82 under 35 U.S.C. § 103(a). Accordingly, the Applicant respectfully requests reconsideration and allowance of the present application with the above-amended claims.

Double Patenting

Claims 19-31 and 82 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, and 19-21 of U.S. Patent No. 6,168,709 in view of DE 19540780A1. Claims 19-31, 34-72, 81, and 82 were also provisionally rejected under the judicially created doctrine of obviousness-

type double patenting as being unpatentable over claims 1-56 of copending Application No. 09/556,132. The Applicant respectfully traverses these rejections.

The Applicant respectfully submits that claims 19-31 and 82 of the current invention are patentable over claims 1, 3, and 19-21 of U.S. Patent No. 6,168,709 in view of DE 19540780A1. As stated, the referenced U.S. Patent 6,168,709 discloses a process for making porous coke, but does not include a step of adding a chemical to the coke during the quenching step of this thermal cracking process as in this application. Likewise, DE 19540780A1 does not teach a step of adding a chemical to the coke during the quenching step of this thermal cracking process. As stated previously, the Applicant respectfully submits that DE 19540780A1 teaches a method for quenching coke with aqueous salt solutions, but not within the cracking process of this application nor for a similar purpose or use. That is, DE 19540780A1 teaches a method for quenching coke with aqueous solutions of iron (II) and iron (III) salts or monoester disodium salts of succinic acid with oxyethylenenonyl phenol. However, the 700-1000 °C temperatures (i.e., 1292 – 1832 °F) of the unquenched coke in this referenced patent indicate that the coke that is being quenched is likely from a coal-coking process or a low temperature coke calciner, but not within the quench step of this thermal cracking process, wherein coke temperatures prior to quench are in the range of 400 – 500 °C (i.e., 752 – 932 °F). Furthermore, the addition of the these

chemicals in this quench are apparently for the purpose of coagulating organic impurities from biologically cleaned process water (used as quench water) to reduce environmental emissions of this quench process. Thus, DE 19540780A1 does not teach a step of adding a chemical compound to the coke structure during the quenching step of the thermal cracking process of this application. In addition, DE 19540780A1 uses types of salt solutions (vs. those of the current invention) for different purposes, reducing environmental emissions from the coke quench due to the use of biologically cleaned process water (vs. coke fuel performance & environmental impacts). In any case, the methods described by DE 19540780A1 apparently do not teach the controlled injection of selected chemical compounds (e.g., sulfur adsorbents) via quenching petroleum coke within the decoking cycle of the coking process in the current invention. Consequently, the Applicant respectively submits that the methods of the current invention which provide controlled injection of selected additives via coke quench for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts of burning coke are distinguished over the quenching of coke with aqueous solutions of different types of salts in a different coking process (e.g., coal coking or low temperature coke calcining) of DE 19540780A1. Furthermore, neither of the cited references provides any motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention. Therefore, the Applicant respectfully submits that claims 1, 3, and 19-21 of U.S. Patent No. 6,168,709

in view of DE 19540780A1 cannot support the rejection of claims 19-31 and 82 of the current invention under the obviousness-type double patenting doctrine.

The Applicant respectfully submits that claims 19-31, 34-72, 81, and 82 of the current invention are patentable over claims 1-56 of copending Application No. 09/556,132. The Applicant respectfully traverses the rejection. This application is a filing under 35 U.S.C. § 371 based on International Application No. PCT/US99/19091, which has an international filing date of August 20, 1999. On the other hand, Application No. 09/556,132 is a continuation-in-part application that was filed on April 21, 2000. Accordingly, the Applicant respectfully submits that the provisional double patenting rejection may be properly withdrawn.

In the event that the Examiner does not withdraw the double patenting rejections, the Applicant respectfully requests the Examiner to hold the double patenting rejections in abeyance until such time that allowable subject matter is indicated.

Conclusion

The Applicant has distinguished claims 19-31, 34-65, and 82 over the cited references. Therefore, the Applicant respectfully submits that the present application is now in condition for allowance, and such action is earnestly requested.

Respectfully submitted,

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